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09/995,421	11/27/2001	Won-Young Chung	5649-909	1882

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EXAMINER

GEBRESILASSIE, KIBROM K

ART UNIT PAPER NUMBER

2128

DATE MAILED: 07/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/995,421

Applicant(s)

CHUNG ET AL.

Examiner

Kibrom K. Gebresilassie

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on 27 November 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 March 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☒ Certified copies of the priority documents have been received in Application No. 09/995,421.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 11/27/2001.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

1. This action is responsive to the application filed on November 27, 2001.
2. Claims 1-35 are examined and rejected.

***Information Disclosure Statement***

3. The Office acknowledges receipt of the Information Disclosure Statement filed November 27, 2001. It has been placed in the application file and the information referred to therein has been considered.

***Priority***

4. The priority date considered for this application is January 03, 2001.

***Specification***

5. The disclosure is objected to because of the following informalities:
  - i. On page 7 lines 25, "magnetic filed direction" should be replace by "magnetic field direction".
  - ii. On page 9 line 10, "1n(R)" should be replace by "ln(R)".
  - iii. On page 15 line 20, the error calculation of 217 and 2019 should be corrected. For example, If the error calculation of 2454 and 2560 is negative then the error calculation of 217 and 2019 should be negative too.

Appropriate correction is required.

***Claim Objections***

6. Claim 29 is objected to because of the following informalities: the claim include a special character of copyright and a close parenthesis "©)". The examiner assumed as "of".

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 32-35 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- As per Claim 32, it's unclear what Applicant's intended metes and bounds are for the claim, since none of the modules are recited as recorded on the media, instead the media is stated to have the intended use of "for recording" the modules.

***Claim Rejections - 35 USC § 101***

9. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

10. Claims 1-18 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. *The Examiner submits that Applicant's have not recited any limitations relating to a practical application in the technological arts and have merely claimed a manipulation of non-functional descriptive material or, at best, software per se. Section 2106 [R-2] (Patentable Subject Matter - Computer-Related Inventions) of the MPEP recites the following:*

*"In practical terms, claims define nonstatutory processes if they:*

- consist solely of mathematical operations without some claimed practical application (i.e., executing a "mathematical algorithm"); or*
- **simply manipulate abstract ideas**, e.g., a bid (Schrader, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (Warmerdam, 33 F.3d at 1360, 31 USPQ2d at 1759), **without some claimed practical application.**"*

*An invention which is eligible for patenting under 35 U.S.C. § 101 is in the "useful arts" when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a **"useful, concrete and tangible result."** The test for practical application as applied by the examiner involves the determination of the following factors:*

*(1) "Useful" - The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished.*

*(2) "Tangible" - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.*

*(3) "Concrete" - Another consideration is whether the invention produces a "concrete" result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.*

*The Examiner respectfully submits, under current PTO practice, that the claimed invention does not recite either a useful, concrete, or tangible result and is merely drawn to a manipulation of abstract ideas.*

- Claim 1 appears to be directed to an abstract mathematical manipulation, and does not bring in the real-world practical application of the process.

The method doesn't require operating the chamber and measuring real-

world data or using the generated "generalized model" for anything, either of which would overcome the problem. Claims 2-9 don't appear to resolve the problem too.

- For claim 10, Applicant has invoked §112, 6th paragraph by using "means for" language. However, a review of Applicant's specification does not appear to limit any of the means beyond software subroutines. Since the apparatus includes no hardware to permit the software to realize it's functionality, the claim appears to be directed to software, per se, not tangibly embodied in a manner so as to be executable. Furthermore, claims 11-18 don't appear to resolve the problem.

***Claim Rejections - 35 USC § 103***

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. Claims 1-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,014,943 issued to Arami in view of Dimitris P. Lymberopoulos and Demetre J. Economou,

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" Two-Dimensional Self-Consistent Radio Frequency Plasma Simulations Relevant to the Gaseous Electronics Conference RF Reference Cell", Journal of Research of the National Institute of Standards and Technology, Vol. 100, No. 4, July-August 1995, and in further view of Applicants Own Admission, herein referred to as AOA.

**As per Claim 1:**

Arami discloses a method of estimating characteristics of a plasma contained in a reaction chamber (process chamber; col. 1 line 23) of a plasma reactor (etching device; col. 5 lines 7, Fig. 1) including a plurality of magnets (segment magnets M1-M40; Fig. 2) that move with respect to the reaction chamber (col. 6 lines 49-51), the method comprising: computing plasma characteristics for each of a plurality of cross-sections of the reaction chamber (Fig. 2); and generating a generalized model of the plasma from the computed plasma characteristics for the plurality of cross-sections.

Arami fails to disclose plasma characteristics and generating a model of plasma from the computed plasma characteristics for a plurality of cross sections. Lymberopoulos discloses plasma characteristics (page 473, right hand side column, paragraph two, lines 9-11) and generating a model of plasma (page 475, left hand side column, under a title "**3. Plasma Simulation**" lines 1-2) from the computed plasma characteristics for a plurality of cross sections.

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Arami related to a plurality of magnets that move with respect to the reaction chamber and for each plurality of cross sections of the reaction chamber with the teachings of Lymberopoulos related to computing plasma characteristics and generating of a generalized model of the plasma. The motivation for doing so would have been

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more convenient to understand surface reaction and other behaviors associated with the plasma processing and to reduce the cost and time by simulating plasma characteristics.

**As per Claim 2:**

Arami discloses the plurality of moving magnets rotate about an axis of rotation, and wherein each of the plurality of cross-sections includes the axis of rotation (col. 2 lines 35-36; col. 6 lines 42-45; Fig. 2).

**As per Claim 3:**

Lymberopoulos discloses computing electron density and temperature (electron density and temperature; page 481, left hand side column, a paragraph starting with "Combining Eq. (36) with..." lines 3-4) for the cross-section using an iterative Monte Carlo computational procedure (page 475, right hand side column, a paragraph starting with "There are three kinds ..." line 9); and

computing ion and neutral species transmission phenomena (page 482, right hand side column, paragraph two, lines 1-3) for the cross-section from a plasma dynamics simulation (plasma simulation, which in turn provide insight into plasma dynamics; page 473, right hand side column, last line of a paragraph and continue the first line of page 474).

**As per Claim 4:**

Lymberopoulos discloses computing the ion and neutral species transmission phenomena for the cross-section from a plasma dynamics simulation comprises computing solutions to a continuity equation and Poisson's equation for the ion and neutral species (page 483, left hand side column, a paragraph starting with "In order to decouple..." lines 6-10).

**As per Claim 5:**

Arami discloses static magnetic field (col. 1 lines 30-35; Fig. 4).



Further, Lymberopoulos discloses computing the plasma characteristics for each of the plurality of cross sections from determined shape information (anisotropy (shape of microscopic features etched into the wafer); page 475, left hand side column, under a title **"2. Problem Statement"** lines 12-13) for the reaction chamber, and plasma collision reaction data (page 474, right hand side column, last paragraph, lines 3-7).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Lymberopoulos related to computing the plasma characteristics from determined shape information and collision reaction data with the teachings of Arami related to determined static magnetic field along the surface of reaction chamber. The motivation for doing so would have been more convenient to meet the requirements for manufacturing of semiconductors by determining the uniformity of magnetic field, anisotropy and collision reaction data within the reaction chamber. Hence a skilled artisan having access to the teaching of Arami and Lymberopoulos would have knowingly modified the teaching of Arami with Lymberopoulos.

**As per Claim 6:**

Lymberopoulos discloses generating a generalized model of the plasma from the computed plasma characteristics for the plurality of cross-sections comprises computing at least one of an electron density distribution, a temperature distribution, a distribution of ion species, a distribution of neutral species, and a flux incidence (page 475, right hand side column, under a title **"2. Problem Statement"** lines 4-10).

**As per Claim 7:**

Lymberopoulos discloses generating a generalized model of the plasma from the computed plasma characteristics for the plurality of cross-sections comprises averaging the

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computed plasma characteristics for each of the plurality of cross-sections (page 475, left hand side column, under a title " **2. Problem Statement**" lines 16-17).

**As per Claim 8:**

Lymberopoulos discloses estimating an etching rate for a wafer positioned in the chamber from the generalized model of the plasma (page 475, left hand side column, under a title " **2. Problem Statement**" lines 10-12).

**As per Claim 9:**

Arami discloses a dipole ring magnet (DRM) plasma reactor (a plasma generation device having a dipole ring magnet; col. 1 lines 26-27).

**As per Claims 10 and 19:**

The limitations of Claims 10 and 19 have already been discussed in the rejection of Claim 1. They are therefore rejected under the same rationale.

**As per Claims 11 and 20:**

The limitations of claims 11 and 20 have already been discussed in the rejection of Claim 2. They are therefore rejected under the same rationale.

**As per Claims 12 and 21:**

The limitations of Claims 12 and 21 have already been discussed in the rejection of Claim 3. They are therefore rejected under the same rationale.

**As per Claims 13 and 22:**

The limitations of Claims 13 and 22 have already been discussed in the rejection of Claim 4. They are therefore rejected under the same rationale.

**As per Claims 14 and 23:**

The limitations of Claims 14 and 23 have already been discussed in the rejection of Claim 5. They are therefore rejected under the same rationale.

**As per Claims 15 and 24:**

The limitations of Claims 15 and 24 have already been discussed in the rejection of Claim 6. They are therefore rejected under the same rationale.

**As per Claims 16 and 25:**

The limitations of Claims 16 and 25 have already been discussed in the rejection of Claim 7. They are therefore rejected under the same rationale.

**As per Claims 17 and 26:**

The limitations of Claims 17 and 26 have already been discussed in the rejection of Claim 8. They are therefore rejected under the same rationale.

**As per claims 18 and 27:**

The limitations of Claims 18 and 27 have already been discussed in the rejection of Claim 9. They are therefore rejected under the same rationale.

14. Claims 28-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,014,943 issued to Arami as applied to claims 1-27 above, and further in view of Dimitris P. Lymberopoulos and Demetre J. Economou, "Two-Dimensional Self-Consistent Radio Frequency Plasma Simulations Relevant to the Gaseous Electronics Conference RF Reference Cell", Journal of Research of the National Institute of Standards and Technology, Vol. 100, No. 4, July-August 1995,

**As per Claim 28:**

Arami discloses a method of simulating plasma in a plasma apparatus having a plasma reactor and a plurality of permanent magnets, which are asymmetrically arranged (Fig. 13) and rotate around the plasma reactor (col. 6 lines 63-65) at predetermined speed (col. 8 lines 48-53).

Arami fails to disclose the steps of: (a) inputting a plasma reactor shape and process conditions and inputting plasma collision reaction data; (c) computing electron density and temperature by a Monte Carlo method and interpreting the transmission phenomenon of ion and neutral species using the data of the steps (a) and (b) until they are converged; and (d) obtaining overall plasma characteristics using the converged values.

Lymberopoulos discloses the steps of: (a) inputting a plasma reactor shape and process conditions (anisotropy (shape of microscopic features etched into the wafer) and inputting plasma collision reaction data (page 474, right hand side column, last paragraph, lines 3-7); (c) computing electron density and temperature (electron density and temperature; page 481, left hand side column, a paragraph starting with "Combining Eq. (36) with..." lines 3-4) by a Monte Carlo method (page 475, right hand side column, a paragraph starting with " There are three kinds ..." line 9) and interpreting the transmission phenomenon of ion and neutral species (page 482, right hand side paragraph two lines 1-3) using the data of the steps (a) and (b) until they are converged (page 489, left hand side column, first paragraph, lines 14-15); and (d) obtaining overall plasma characteristics (plasma behavior; page 473, right hand side column, paragraph two line 11) using the converged values.

Further, AOA discloses (b) 3-dimensionally computing static magnetic fields induced by the permanent magnets (page 6 lines 27-31);

**As per Claim 29:**

Arami discloses plasma simulation at 2-dimensional cross-sections for cross-sectional magnetic field distribution in a characteristic magnetic field direction (Fig. 2, Fig 4).

**As per Claim 30:**

Lymberopoulos discloses 2-dimensional plasma simulation (page 487, left hand side column, last paragraph) is performed for a plurality of 2-dimensional cross-sections including an

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axis, obtains convergence values (page 489, left hand side column, first paragraph, lines 14-15) for the respective cross-sections, and averages them to obtain plasma characteristics (page 484, left hand side column, a paragraph starting with " The time average..." lines 1-3).

**As per Claim 31:**

Arami discloses DRM plasma apparatus (col. 1 lines 25-26).

**As per Claim 32:**

The limitation of claim 32 has already been discussed in the rejection of claim 28. It is therefore rejected under the same rationale.

**As per Claim 33:**

The limitation of claim 33 has already been discussed in the rejection of claim 29. It is therefore rejected under the same rationale.

**As per Claim 34:**

The limitation of claim 34 has already been discussed in the rejection of claim 30. It is therefore rejected under the same rationale.

**As per Claim 35:**

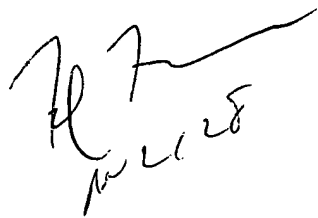
The limitation of claim 35 has already been discussed in the rejection of claim 31. It is therefore rejected under the same rationale.

***Conclusion***

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
2. Any inquiring concerning this communication or earlier communication from the examiner should be directed to Kibrom K. Gebresilassie whose telephone number is (571) 272-8571. The examiner can normally be reached on Monday-Friday, 8:30 am to 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner supervisor, Jean

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R. Homere can be reached at (571) 272-3780. The official fax number is (703) 872-9306. Any inquiring of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is (571) 272-3700.

A handwritten signature, possibly "R. Homere", is written in black ink. Below the signature, the date "10/11/28" is written in a similar cursive style.